The Dynamic Mesh Method in CFD Simulations of Flap-type Wave Energy Converters

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In this research, a Computational Fluid Dynamics (CFD) analysis is conducted in order to simulate the free-decay motion of a flap-type Wave Energy Converter (WEC) and, thus, quantifying viscous damping effects. The numerical model was set up in OpenFOAM, considering a rectangular flap and an elliptical flap similar to the one proposed in [1]. Within the context of COST Action CA17105, a Short Scientific Mission (STSM) was granted to the first author of this abstract for implementing the numerical set up of the CFD model.

The examined flap configurations are fully-submerged and their initial position is defined by applying an initial rotation to the flap. Several tests have been performed with different angles of release. Since the examined flap is rotating about a fixed axis, the mesh has to be adapted at every time step. Accordingly, the dynamic mesh method is selected for the CFD simulations along with the 'interDyMFoam' solver. This solver utilizes a Volume-Of-Fluid (VOF) phase-fraction based interface capturing approach and it can apply adaptive re-meshing for addressing the required mesh motion. The rotation of the flap is specified as a combination of constrains in the 'sixDoFRigidBodyMotion' library of the solver. Since the dynamic mesh is a complex process in CFD modelling, a series of trial simulations was implemented to address correctly the physical problem and achieve the required motion of the mesh. The results of this research will be further utilized for enhancing the numerical modelling of the system proposed in [1] and for optimizing its design.

References

[1] Sismani G and Loukogeorgaki E (2020). "Frequency-based investigation of a floating wave energy converter system with multiple flaps", Applied Mathematical Modelling Journal, 84C, pp. 522-535.

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